

CHAPTER THREE

AFFECTED ENVIRONMENT

This chapter briefly describes the environmental components that might be affected by the Nicore project. It forms the basis for the Environmental Consequences of the No Action Alternative. The focus of this chapter is on significant issues as discussed in Chapter Two, however some discussion about other resources that might be affected is included. Discussions from previous analysis efforts are summarized and incorporated by reference, including the West Fork Illinois River Watershed Analysis, the Rough and Ready Wild and Scenic River Eligibility Study, Siskiyou and Northwest Forest Plan and associated documents, BLM Resource Management Plan and associated documents, Draft BLM Area of Critical Environmental Concern Management Plan and associated documents, Draft Species Management Guides for various sensitive plants, State Plans for Anadromous Fish restoration, and other documents.

PHYSICAL ENVIRONMENT

The physical setting of Rough and Ready Creek watershed is described at length within the Physical Science Report for the Nicore Project, the West Fork Illinois River Watershed Analysis and the Rough and Ready Creek Wild and Scenic Eligibility Study (available in the Analysis files).

Ninety three percent of the Rough and Ready watershed is underlain by ultramafic rocks (peridotite and serpentinite) and weathered soils. The characteristics of the soils at the four proposed sites are listed in Figure 12. All the information is from the Josephine County Soil Survey, completed in December 1983. The type of soils found near the proposed ore pits in the Rough and Ready Drainage make up approximately 11.5 % of the total land area in Josephine County.

Permeability is slow in all soils. Organic content ranges from 3 to 10%. The surface layer (topsoil) is a stony clay loam and generally very shallow (2-10"). This topsoil contains a high percentage of rocks greater than 3" in diameter (25-75%). The sub-soil in these associations is generally even more rocky than the surface layer.

Of particular interest to this analysis are the nickel, chrome and cobalt-bearing soils known as laterites. These residual soils lie on an old 'upland weathered surface and in lower slump and benches as well as in outwash deposits mixed with sand and gravel on the valley floor' (Ramp, 1978). Laterites are generally formed under warm, wet conditions over many, many years (Bates and Jackson, 1979). The nickel content in the soil varies by site but ranges from 0.57-1.23%, cobalt from 0.07 to 0.14%, and chrome from 1.06-2.56%.

	Site A	Site B	Site C	Site D
Soil Types	33F & 58F (Eightlar-Dubakella Complex & Pearsoll-Rock outcrop complex)	58F & 31E, (Pearsoll-Rock outcrop complex & Eightlar extremely stoney clay)	58F (Pearsoll-Rock outcrop complex)	58F (Pearsoll-Rock outcrop complex)
Soil Taxonomy	Clayey-skeletal, serpentinitic, mesic Typic Xerochrepts and Mollic Haploxeralfs; Clayey-skeletal, serpentinitic mesic lithic Xerochrepts.	Clayey-skeletal, serpentinitic mesic lithic Xerochrepts; Clayey-skeletal, serpentinitic mesic mollic Haploxeralfs.	Clayey-skeletal, serpentinitic mesic lithic Xerochrepts	Clayey-skeletal, serpentinitic mesic lithic Xerochrepts
Soil Chemistry				
pH	6.1-7.8	6.1-7.3	6.1-7.3	6.1-7.3
CEC	25-75 meq/100 grams of soil (NH ₄ OAc)	Similar	Similar	Similar
Soil & Water Features				
Flooding Potential	None	None	None	None
High Water Table	Greater than Six Feet in Depth	Greater than Six Feet in Depth	Greater than Six Feet in Depth	Greater than Six Feet in Depth
Bedrock Depth	Varies between 20 inches to greater than 60 inches in depth.	Greater than 60 inches in depth.	Greater than 60 inches in depth.	Greater than 60 inches in depth.
Bedrock Hardness	Hard	Hard	Hard	Hard
Hydrologic Group	C&D - Very slow infiltration rate and high run-off rate	C&D - Slow to very slow infiltration rate and high run-off rate	D - Very slow infiltration rate and high run-off rate	D - Very slow infiltration rate and high run-off rate
Physical & Chemical Properties				
Permeability	<0.06 to 0.2 in/hr (very low)	<0.06 to 0.2 in/hr (very low)	<0.06 to 0.2 in/hr (very low)	<0.06 to 0.2 in/hr (very low)
Shrink-Swell Potential	Moderate to High	Moderate to High	High	High
Erosion Factors	k=0.17 to 0.24	k=0.17 to 0.24	k=0.17 to 0.24	k=0.17 to 0.24

Figure 12. Soil Features in Mine Sites A, B, C and D

Ramp notes that there are at least 512 acres in bench deposits of nickel bearing laterite, and at least as many acres have potential (but were not sampled by Ramp). There are also at least 1000 acres of outwash (Rough and Ready alluvial flat) that also contain low concentrations of nickel, chrome and cobalt. Figure 13 shows the 512 acres of nickel bearing laterites mapped by Ramp.²⁴

The dominant erosion process in this watershed over long time scales is large landslides (see West Fork Illinois River Watershed Analysis); gullying and rill erosion are more important on shorter time scales. Roads and stream crossing approaches exist throughout the proposed haul route. These are not currently passable with pickups, but have been used extensively in the past. These roads and crossings contribute small, but generally not measurable quantities of sediment to the stream system. The dominant erosion processes on these surfaces are surface wash and rilling.

Rough and Ready Creek is known for its exceptional water clarity and lack of fine sediment.²⁵ Existing rates of coarse sediment transport along the bed of the stream were modeled at a cross-section located near Proposed Crossing #4. The simulated flow level for the modeling exercise was bankfull flows, or those flows expected to occur on average once every 1.5 to 2 years. These are the flows most linked to channel bed formation and maintenance. The model (winxpro) estimated that bankfull flows transport approximately 1,860 tons per day through this cross-section. There have been no measurements of bedload sediment transport taken to validate this estimate.

Streamflow varies by tributary and by season. Generally, the area is noted for its ‘flashy’ nature, marked by a rapid rise and fall in stream flow in response to precipitation. Summer flows are often critically low, the stream goes sub-surface in several locations in many years.

Few flow measurements have been taken on Rough and Ready Creek. In the summer of 1997, however, Oregon Department of Water Resources, Josephine County branch took the following data:

R&R near Mouth	May 16	48.7 cfs
	June 6	41.9 cfs
R&R below Seats Dam	May 16	39.3 cfs
	June 6	50.1 cfs
	July 2	16.6 cfs
	July 18	9.8 cfs
	Aug 15	3.6 cfs
	Aug 29	4.3 cfs

Stream flow is used to support numerous beneficial uses in the area. According to data collected by the Oregon Department of Water Resources, there are recorded water rights on Rough and Ready Creek for domestic use, stock, irrigation, and fish.

²⁴Figure 13 represents the extent of reasonably foreseeable future mining. The sites proposed for mining under the current Plan of Operations are nested within these deposits. The mine claimant has stated that mining of these 512 acres would take over 50 years to accomplish.

²⁵Rough and Ready Creek is considered optimum for sediment in relationship to beneficial uses such as swimming (primary contact), fish, domestic, etc.

See FIGURE 13

back of map

Summer water temperatures in R&R exceed the 64 degree (F) State standard for many days during the season (water temperatures exceeding 80 degrees (F) have been measured during low flow). Rough and Ready Creek, and the West Fork Illinois River, are considered Water Quality limited due to high summer water temperatures and are legally listed as impaired under Section 303(d). High stream temperatures are inherent to the watershed. The Department of Environmental Quality (DEQ) is in the process of determining Total Maximum Daily Loads (TMDL) relative to temperature increases. The mining operation would be subject to DEQ and other stipulations and regulations.

The geochemistry of the surface waters (9 sites) and the chemistry of the bed sediments (8 sites) in R&R Creek was studied as part of a monitoring program established by the US Geological Survey. They found that pH values ranged from 7.63 to 8.58, conductivity from 120 to 277 uS/cm, and that alkalinity ranged from 75 to 182 ppm. Additionally, “the concentration of elements that may be a concern for aquatic and public health are generally low, particularly for Copper, Zinc, Arsenic, Cobalt, Selenium, Uranium and nitrates” (Miller, et al 1998). The report goes on to conclude, “High alkalinites...indicate good capacity for buffering acid generation from possible sources such as acid rain and acid-mine drainage”(ibid).

The USGS also found that “nickel...is elevated relative to average fresh water values” (ibid.). Currently, the concentration of nickel in water samples taken from Rough and Ready Creek and some nearby springs exceeds the Department of Environmental Quality Ambient Water Standards for fish and water ingestion (13.4 ppb). Water samples taken in the mainstem of Rough and Ready Creek ranged from 13 to 17 parts per billion (ppb). Samples taken from tributaries and springs along the creek ranged from 11 to 36ppb. Samples were also taken (by the Forest Service) from springs used for drinking water. Nickel concentrations there ranged from 30 to 40ppb. The USGS and Forest Service water chemistry data is in the analysis files.

Numerous springs emerge along the length of the channel. Many of these issue from channel banks and through-flow in the gravel. Roads existing within the watershed may have affected these springs, particularly near Crossing #6. The term hyporheic zone refers to the interface between ground and surface water; the hyporheic zone was found to be unusually extensive at the Rough and Ready alluvial fan (see Wild and Scenic River Eligibility Study).

Groundwater depths are not known, but wells in the area vary in depth. Recharge of wells from filling of the Wing and Farren ditch has been reported (see G. Buck, W. Brown, and other scoping comments in the analysis files).

Rough and Ready Creek is noted for its unusual channel morphology and large substrate in its lower gradient, unrestricted reaches. The alluvial fan at the mouth of Rough and Ready Creek is unique for a stream of this size within the Klamath Province. Thus, the geological/hydrological character of the main stem is considered an Outstandingly Remarkable Value.

There are other streams within project area, including Rock Creek, Woodbury Creek, and numerous unnamed tributaries in Section 27 that drain to the West Fork of the Illinois River. Little specific data is available regarding these creeks. Review of topographic maps and air photos suggest they are steep, sparsely vegetated, and flashy in response to precipitation.

Water quality in the West Fork Illinois River is good, although not as clear as Rough and Ready Creek. The sources of sediment to the West Fork likely include roads, streamside slides, and channel bed and bank erosion (studies have not been done to confirm this assumption).

PROPOSED, ENDANGERED, THREATENED and SENSITIVE FISH SPECIES

Native salmonids present within the analysis area include: resident rainbow and cutthroat trout; and anadromous winter steelhead trout, fall chinook salmon, and coho salmon.

Resident rainbow and cutthroat trout occur throughout Rough and Ready Creek and many of its tributaries. The upper reaches of both the North and South Forks are likely more significant spawning and rearing sites than the main stem.

Winter steelhead trout spawn and rear throughout most of Rough and Ready Creek and many of the tributaries. Observations during summer 1997 identified low to moderate concentrations of juveniles at the proposed creek crossing sites and throughout the lower reaches of the creek.

Fall chinook salmon are known to spawn and rear on Rough and Ready Creek. Habitat on the West Fork of the Illinois River, immediately adjacent to Rough and Ready Creek, is currently classified as High Value Native Fall Chinook Salmon Habitat by the State of Oregon.

Juvenile and adult coho salmon have been documented on Rough and Ready Creek. Most recently, three juvenile coho were found at Seats Dam (USFS 1998). The area has not been identified as High Value Habitat for coho by ODFW, but 300 feet on either side of the main stem is part of the critical habitat for coho designated by the National Marine Fisheries Service under the Endangered Species Act.

Coho salmon are listed as threatened under the Endangered Species Act. Chinook salmon are proposed for listing. FS Region Six sensitive species include steelhead and cutthroat trout. Rough and Ready Creek does not inherently provide high quality habitat for any of these species. Cool springs and a few deep pools provide some potential refugia for fish, but the high temperatures, low flows and seasonal barriers to juvenile salmonid migration from dams and diversions make Rough and Ready Creek a relatively inhospitable environment for anadromous fish.

Figure 14 describes existing fish habitat conditions within the lower reaches of Rough and Ready Creek. The 'response reach' is the area most likely to be affected by activities (lower gradient reaches in the vicinity of the stream crossings). The definitions of "optimum", "marginal" and "outside optimum range" were established for the Klamath/Siskiyou Mountains, but have not been adapted to serpentine environments. Criteria for optimum vs. outside optimum range is available in the Fish, Wildlife, and Aquatic Conservation Strategy Evaluation in the analysis file.

FACTORS AND INDICATORS	Lower Rough and Ready Creek Response Reach		
	Optimum	Marginal	Outside Optimum Range
Temperature			X
Physical Barriers		X	
Sediment	X		
Large Wood		X	
Pool Quality		X	
Off-channel Habitat		X	
Width/Depth Ratio		X	
Streambank Condition		X	
Floodplain Connectivity		X	
Changes in Peak Flow	X		
Road Density and Location		X	
Human Disturbance History		X	
Riparian Reserves		X	
Landslide and Erosion Rates	X		
Harassment and Incidental Take	X		

Figure 14. Matrix of Factors and Indicators for Fish Habitat- Existing Condition

PORT-ORFORD-CEDAR ROOT DISEASE

Port-Orford-cedar (POC) is a conifer endemic to southwestern Oregon and northwestern California. POC occupies a variety of ecological zones; moist areas are favored, but it also grows on dry sites. *Phytophthora lateralis* (POC root disease) was first encountered on POC in nursery stock in Seattle, Washington, in 1923. It has now spread to about seven percent of the area occupied by POC on National Forest; disease centers are scattered throughout the northern half of the natural range of POC. High risk areas for infestation are stream courses, drainages, or low-lying areas downslope from infestation centers. Long distance spread of the disease pathogen has occurred through earth movement in road construction, road maintenance, logging, and traffic flow on forest roads. Road use during wet periods is associated with high risk. Movement of the pathogen in soil clinging to the feet of cattle and elk has also been documented. Topography has a considerable influence on spread; concave areas with POC are especially vulnerable because they are easily flooded.

Within the analysis area, POC is found in riparian areas and around small seeps. POC is the primary riparian component in some areas. The larger POC are 20 to 40 inches in diameter and are 200 to 400 years old. POC also grows outside of riparian areas in some places outside of riparian areas. POC provides many ecosystem benefits including shade, soil nutrients, long lasting wood in creeks and beauty.

The West Fork Illinois River Watershed Analysis includes a map of POC and root disease distribution within the watershed. Root disease has been identified on the West Fork, but has not been found in the Rough and Ready Creek watershed.²⁶

There are two possible explanations for the lack of root disease in the Rough and Ready Watershed:

- (1) Limited Access - the area is generally inaccessible to motorized traffic, especially during the wet season;
- (2) Gaps in POC distribution inhibit the spread.

Two areas within the Rough and Ready Creek watershed that may be accessed by the Proposed Action haul route are particularly vulnerable to the spread of root disease; the No Name Fan area and the population up Alberg Creek. They are vulnerable because they are low-lying populations in wet areas that are near roads. The presence of the cedar is an integral part of the habitat in these areas. Other areas of concern include the ditch lines of roads where POC is concentrated and headwater areas.

NOXIOUS WEEDS

Serpentine-dominated landscapes are inhospitable to many plants, including noxious weeds. Noxious weeds are designated by the Secretary of Agriculture or by individual states. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of a serious insect or disease, or being native or new to or not common to the United States or parts thereof.

Some non-native species can grow on serpentine, and in some cases, can out-compete native vegetation. Known noxious weeds species within the analysis area include scotch broom (*Cytisus scoparius*), yellow star thistle (*Centaurea solstitialis*), Himalayan blackberry (*Rubus discolor*), knapweed (*Centaurea sp*), mullein (*Verbascum thapsus*), orchard grass (*Dactylis glomerata*), cheat grass (*Bromus tectorum*), intermediate wheat grass (*Elytrigia intermedia*), velvet grass (*Holcus lanatum*), bull thistle (*Cirsium vulgare*), white clover (*Trifolium repens*), and dandelion (*Taraxacum officinale*). Survey data reveals that noxious weeds have not occupied the proposed mine sites. Most of the haul route is also free of noxious weeds, except along the powerline on BLM lands.

Two species are of greatest concern, scotch broom and star thistle. A large population of scotch broom occurs along the Wimer Road, between Hwy 199 and the National Forest boundary. Star thistle grows along 199 at the Botanical Wayside and near the miner's residence.

²⁶Two concentrations of dead cedars along Rough and Ready Creek were investigated, but root disease was not found. The trees were probably damaged by flathead borers (found on site) and/or high water.

Standard and Guideline 12-6 in the Siskiyou National Forest Plan states, "Control of noxious weeds should be accomplished in cooperation with state, county, and private organizations through Weed Control Districts or Coordinated Resource Management Agreements. Preventative management is critical to an effective control program."

Botanical area management emphasizes controlling noxious weeds. The Illinois Valley Garden Club and other groups have spearheaded efforts to eradicate star thistle from the Botanical Wayside (hand pulling). Their efforts have been successful, and the population appears to be diminishing. The current risk of spread is high within the BLM ACEC, along the power line and other roads in the analysis area. Areas commonly accessed by the public, such as the "Mars" swimming hole, are at risk of establishment of noxious weeds.

BOTANICAL DIVERSITY AND SENSITIVE PLANTS

The analysis area is renowned for its botanical diversity and abundance of rare plant species. Scientific and educational interest in the area (along with the rest of the Josephine Peridotite Sheet) is high. The low calcium, high magnesium, and the high metal concentrations in serpentine soils result in conditions toxic to many common species. Some species have developed mechanisms to deal with these conditions; serpentine endemics are species found *only* within serpentine habitats. The highest concentrations of rare plants within the analysis area are found on rocky slopes, wet areas, alluvial flats, and Jeffrey pine savannah habitats.

Several botanical areas have been designated within the analysis area. The BLM ACEC, Forest Service Rough and Ready Botanical Area, Forest Service Oregon Mountain Botanical Area, and the State Botanical Wayside comprise about 3500 acres within the analysis area. The botanical resources are also recognized as an Outstandingly Remarkable Value (ORV) within the Rough and Ready Creek corridor. The presence of many rare and endemic plant species throughout the analysis area has been documented in the following reports:

- *Appendix F of the Siskiyou National Forest Plan FEIS includes a description of the Rough and Ready Botanical Area.

- *A Preliminary Flora for the Rough and Ready Creek watershed (Borgias 1994) included 278 species.

- *The 1993 Rough and Ready Wild and Scenic River Eligibility Study includes known and potential plant lists.

- *The Oregon Natural Heritage Program (ONHP) maintains a database of known rare plant habitats and sites. This database has been updated to include plant surveys accomplished in 1997.

- *The West Fork Illinois River Watershed Analysis discusses 45 Siskiyou endemics found within the West Fork Illinois River Watershed, many of which also grow in the analysis area.

The analysis within this EIS focuses on the rarest (PETS) species within the analysis area; these are federally listed endangered species, FS Region 6 "Sensitive" and BLM "Special Status" species. The mine and stockpile sites, and existing and proposed roads that may be used for ore haul have been surveyed for presence of these plants. Private land was not surveyed. Potential effects would occur on fourteen species of PETS plants: *Arabis macdonaldiana*, *Calochortus howellii*, *Cardamine nuttallii* var. *gematta*, *Epilobium oregonum*, *Fritilaria glauca*, *Gentiana setigera*, *Hastingsia atropurpurea*, *Microseris howellii*, *Monardella purpurea*, *Perideridia erythrorhiza*, *Salix delnortensis*, *Senecio hesperius*, *Streptanthus howellii*, and *Viola primulifolia* var. *occidentalis*. Some species discussed in the SDEIS were removed from the Pacific Northwest Regional Forester's Sensitive list in May 1999 and are not discussed further: *Epilobium rigidum*, *Hieracium bolanderi*, *Poa piperi*, *Sanicula peckiana* and *Mimulus douglasii*.

The sensitive plants occur on four types of habitats: ultramafic, riparian, rock outcrops, and forested. Most of the suitable ultramafic habitat within the analysis area is currently intact or if disturbed, is within the tolerance limits of the species of concern. Riparian habitats have been degraded, and created, by human disturbance, such as road and diversion ditches. Several species of water-loving plants, including some uncommon species, have colonized human-created habitats. Rock outcrops and forested habitats are found throughout the area. Roads have degraded these habitats, but some plants are becoming re-established on roads that are no longer being used. Information known about the 14 PETS plant species is summarized below:

Macdonald's rockcress (*Arabis macdonaldiana*) is endemic to the Red Mountain of the North Coast Range of California; it has federal protection as Endangered. The USDI FWS made a decision in 1997 that all known populations of *Arabis macdonaldiana* share the same taxonomy and genetic material. It occurs on barren to shrub-covered shallow, rocky, ultramafic soils which are peridotite in origin (Jeffrey pine woodland community). Elevation ranges from 500 to 4,000 feet. Known populations on the Siskiyou NF are found between North Fork Smith River and Diamond Creek, Packsaddle Mountain and East Fork Illinois River. A specimen from the project area sent to arabis expert Dr. Linda Vorobik was confirmed to be *A. macdonaldiana*. The Rough and Ready populations extend the range of this species in Oregon. In June of 1998, Vorobik visited these sites and located an additional population and unoccupied suitable habitat on the proposed ridge road to mining site A. Six locations total are known in the analysis area.²⁷

Howell's mariposa lily (*Calochortus howellii*) is endemic to the Illinois Valley in southwest Oregon. It occurs on serpentine soils, dry rocky slopes, often on *Ceanothus* brush-covered slopes or in open Jeffrey pine stands, from 800 to 4,200 feet elevation. The northernmost known populations on the Siskiyou NF occurs just north of Eight Dollar Mountain and the southernmost site is at the foot of Oregon Mountain. Between these two sites, additional populations are discontinuous and scattered. The westernmost population occurs at Oregon Mountain and the most eastern population known is that of Democrat Gulch. Most populations are sparse and scattered. Seventeen locations are known within the analysis area.

Purple toothwort (*Cardamine nuttallii* var. *gemmata*) is endemic to the Siskiyou Mountains of Josephine and Curry Counties, Oregon to adjacent Del Norte and possibly Siskiyou Counties, California. It occurs on gravelly serpentine soils on ridges, Jeffrey pine forests, near *Darlingtonia* bogs, and at a wide range of elevations. Known populations on the Siskiyou NF occur at Red Mountain, Oregon Mountain, Waldo, Snow Camp, Wimer Road, Tincup Pass, Canyon Creek, Eight Dollar Road, Pearsoll Peak, Lemmingsworth Gulch, and Vulcan Peak. Five locations are known in the analysis area.

Oregon willow-herb (*Epilobium oreganum*) is a Klamath Province endemic occurring in *Darlingtonia* bogs, and other wet serpentine areas from 500 to 7800 feet elevation. All extant populations in Oregon are found on scattered sites in Josephine County. In California, it is found in Siskiyou, Trinity and Humboldt Counties. Known populations on the Siskiyou NF occur along the west side of the Illinois Valley. The majority of plants are found from Eight Dollar Mountain southwest to Josephine Creek. At the south end of its range in Oregon it is found along the Oregon Mountain Road. Most populations are less than 100 plants. Two locations are known in the analysis area.

²⁷Survey results, including specific locations of rare plants, are mapped in the Analysis File.

Siskiyou fritillaria (*Fritillaria glauca*) is found from southern Douglas County, south through the Siskiyou Mountains of Josephine and Curry Counties in Oregon and into California. It occurs on gravelly serpentine slopes and ridges, from 1,800 to 6,400 feet elevation. On the Siskiyou NF this plant is found in about 20 geographical areas. There is one off-forest site at Waldo Lookout. Six locations are known in the analysis area.

Elegant gentian (*Gentiana setigera*) is found in Siskiyou Mountains in southwestern Oregon and in northern California. It occurs on serpentine wet meadows, bogs, and seeps on slopes at low elevation. On the Siskiyou NF there are about 10 geographical areas where this plant is found. Three locations are known in the analysis area.

Purple-flowered rush lily (*Hastingsia atropurpurea*) has a limited range from Eight Dollar Mountain along the west side of Illinois Valley south to Parker Creek in Josephine County, occurring on wet meadows, rocky seeps, serpentine Darlingtonia bogs, often in open areas on gentle slopes, and streambanks in partial shade, from 1,600 to 2,000 feet elevation. Known locations on the Siskiyou NF include Eight Dollar Mountain, Woodcock Creek, Josephine Creek, and Days Gulch. A population of two plants was reported at Rough and Ready Creek in 1989, next to the crossing of road 442/441. This population was not relocated in 1997 and is assumed to be extirpated.

Howell's microseris (*Microseris howellii*) is geographically restricted to serpentine areas of the Siskiyou Mountains, southern Josephine County, Oregon, especially on the west edge of the Illinois Valley. All populations are from 1,000 to 3,500 feet elevation on soils formed from ultramafic rocks. Habitat consists of slopes or flat ground with varying exposures, predominantly within Jeffrey pine/incense cedar/chaparral vegetation. Known populations on the Siskiyou NF occur on Rough and Ready Flat, Illinois River, Eight Dollar Mountain, Oregon Mountain, Days Gulch, Eagle Gap, Tennessee Mountain, Wimer Road, and Cedar Log Bog. It is found off-forest along Deer Creek, Woodcock Bog, and Waldo. Eight locations are known in the analysis area.

Siskiyou monardella (*Monardella purpurea*) is known from Curry and Josephine Counties, Oregon and adjacent California, where it grows on rocky, open slopes on serpentine soils or serpentine bedrock from 1,400 to 4,000 feet elevation. Also found on chaparral, woodland and montane forest. Typical associates include Jeffrey pine, western white pine, and shrubs. Known populations on the Siskiyou NF are documented from the trail to Silver Peak, Lemmingsworth Gulch, Oregon Mountain, York Creek, Vulcan Peak, Rough and Ready Creek and Weston Ridge. Four locations are known in the analysis area.

Red-root yampah (*Perideridia erythrorhiza*) Known from Douglas, Klamath, and Josephine Counties in Oregon, where it inhabits vernal moist depressions in heavy, poorly drained soils. Typical vegetation types associated with this plant are oak or pine woodlands below 5,000 feet in the Cascade Mountains. Josephine County sites are in serpentine habitats. On the Siskiyou National Forest it is found on Josephine Creek and Rough and Ready Botanical Area. There are two locations off-forest at Eight Dollar Mountain. One location is known in the analysis area.

Del Norte willow (*Salix delnortensis*) is known from Curry and Josephine County in Oregon and Del Norte County in California, where it grows on streambeds, streambanks, and gullies on serpentine soils, below 1,500 feet elevation. Known populations on the Siskiyou NF are at Rough and Ready Creek, Josephine Creek, Box Canyon Creek, Star Flat, Cedar Camp, Road to Snow Camp, Meadow Creek, Quosatana Creek, headwaters of Hunter Creek, and Wimer Road. Four locations are known in the analysis area.

Siskiyou butterweed (*Senecio hesperius*) is endemic to the Illinois Valley area of the Siskiyou Mountains and southern Josephine County, Oregon, where it grows on serpentine soils at lower elevations, on gentle to moderate slopes. Generally found in open Jeffrey pine savannah. Most of the known populations are within the boundaries of the Illinois Valley Ranger District. Known populations on the Siskiyou NF occur along Free and Easy Creek, Eight Dollar Mountain and vicinity, Cedar Log RNA, Josephine Creek, Rough and Ready Creek, and West Fork Illinois River. It is found off forest along Laurel Road, Woodcock Bog, and Waldo Hill. Twelve locations are known in the analysis area.

Howell's streptanthus (*Streptanthus howellii*) is known from the Siskiyou Mountains, Josephine and Curry Counties in Oregon, and Del Norte and Siskiyou Counties in California. It grows on dry, rocky, serpentine slopes in conifer/hardwood forests; at 1,000 to 4,500 feet elevation. Known populations on the Siskiyou NF are found near the California line on the road to Sanger Peak, Rock Creek, Cedar Creek, Snow Camp, Lemmingsworth Gulch, Wimer Road, Vulcan Peak, Carpenter Gulch, Eight Dollar Mountain, Josephine Mountain, and South Chetco Rim Trail. Twenty-nine locations are known in the analysis area.

Western bog violet (*Viola primulifolia ssp. occidentalis*) is known from Curry and Josephine Counties, Oregon and Del Norte County, California. It is found in Darlingtonia bogs on serpentine soils at lower elevations. Most of the known populations on the Siskiyou NF are within the boundaries of the Illinois Valley Ranger District. Two locations are known in the analysis area.

Draft species management guides have been prepared for six of the sensitive species: *Calochortus howellii*, *Epilobium oreganum*, *Gentiana setigera*, *Monardella purpurea*, *Senecio hesperius*, and *Microseris howellii*. A “critical fen” from the Draft Fen Conservation Agreement occurs within the analysis area, but is not on any proposed haul route. Studies continue to map and assess the plant composition within all the small wetlands and fens in the area. An analysis using satellite imagery to correlate wet habitats with plant composition also continues.

The West Fork Illinois River Watershed Analysis, the Southwestern Oregon LSR Assessment, the Siskiyou National Forest Plan FEIS and Medford BLM District Resource Management Plan address general vegetative conditions (plant associations, seral stages and density) across serpentine habitats. Discussions in those documents are incorporated by reference and will not be repeated here.

Survey and Manage Guidelines from the Northwest Forest Plan apply to this project. Known sites include a lichen, *Bryoria tortuosa*, within the Rough and Ready Area of Critical Environmental Concern and FS Botanical Area. Surveys for vascular plants (*Cypripedium fasciculatum*, *Cypripedium montanum* and *Allotropa virgata*) have been completed. Habitat for all Survey and Manage Species would be avoided in the Preferred Alternative. Surveys for lichens, fungi and bryophytes would be needed if another alternative (besides No Action or Alternative 9) is selected.

AQUATIC CONSERVATION STRATEGY

The Aquatic Conservation Strategy is a four-pronged approach to maintenance of the natural disturbance regime relative to riparian and aquatic ecosystems. Components of the Aquatic Conservation Strategy include the Riparian Reserve, Key Watersheds, Watershed Analysis, and Watershed Restoration.

Riparian Reserves - Riparian Reserves within the analysis area include: fish-bearing streams, permanently flowing non-fish-bearing streams, seasonally flowing or intermittent streams, wetlands less than 1 acre, constructed ponds and/or wetlands greater than 1 acre (i.e., water diversion ditches, etc.). The characteristics of riparian habitat within serpentine landscapes is displayed in Figure 15.

Key Watersheds - Neither Rough and Ready Creek nor the West Fork of the Illinois River was identified as a Key Watershed in the Northwest Forest Plan.

Watershed Analysis - Rough and Ready Creek was included in the recent West Fork of the Illinois River Watershed Analysis (1997).

Watershed Restoration - Rough and Ready Creek is not presently identified as either a Key Watershed (FS/BLM) or Coastal Salmon Recovery Initiative Core Area (Oregon Department of Fish and Wildlife - ODFW). Therefore, watershed restoration opportunities are a lower priority than others with these designations. However, watershed restoration opportunities were identified for this watershed in the recent West Fork Illinois River Watershed Analysis.

CHARACTERISTICS OF RIPARIAN HABITAT AND ITS FUNCTION WITHIN SERPENTINE ENVIRONMENTS	
	SERPENTINE HABITAT
Stream Morphology/ Substrate	High energy system with cobble substrate, rock weathers directly to silt and clay leaving a track of sands and gravel.
Riparian Zone	Riparian zone very narrow. Riparian vegetation sometimes limited to plants with roots in the creek, rarely extends further than 20 feet from the active channel.
Late-Successional Conditions	May not be capable of providing high quality late-successional habitat (e.g. for species such as spotted owl).
Shade-Producing Vegetation	Trees are larger in narrow riparian zones than surrounding vegetation, but rarely exceed 36" dbh. Stand density generally not capable of exceeding 70% canopy cover; often less than 40%. Port-Orford-cedar is primary source of shade.
Large Wood	Riparian zones not capable of providing ready source of large wood to stream system. Large wood delivered to streams quickly flushed through system.
Intermittent Streams	High proportion of landmass consisting of intermittent Riparian Reserves. Intermittent streams flow during a shorter period of the year. Vegetation alongside intermittent channels varies little from upland conditions.
Perennial Springs and Seeps	Water emerges from bedrock shear zones on slopes and streambanks.
Rare Plant Species	Many rare species are related to riparian habitats, including fens, vernal pools, and seeps.
Response to Disturbance	Revegetation following disturbance slow to become established. Gullies are long lasting.

Figure 15. Riparian Characteristics within the Analysis Area.

WILD AND SCENIC RIVER ELIGIBILITY AND OUTSTANDINGLY REMARKABLE VALUES

Rough and Ready Creek was considered for its Eligibility for Wild and Scenic (W&S) River status. Portions of the creek were found eligible in 1993. The Outstandingly Remarkable Values (ORV's) include botanical, hydrological/geological, and wildlife. These values and the potential classification of various segments of the creek are described in the Wild and Scenic River Eligibility Study in the project file. The next step in the process is a study to determine whether the creek is suitable for inclusion into the W&S River System. The US Congress makes the ultimate decision whether or not to include the river in the system. Until such time that the creek is found not suitable, it will be managed to protect its free-flowing characteristics, potential classification (Wild, Scenic or Recreational) and ORVs.

WORLD NICKEL SITUATION

The world nickel reserves contain at least 130 million tons of nickel (60% in laterites and 40% in sulfide deposits). In addition, there extensive deep-sea resources of nickel on the ocean floor, particularly in the Pacific Ocean. Reserves accessible with current technology would supply about 70 years of total world demand at current levels (Kuck 1999). Despite the larger amount of nickel reserved in lateritic ores, nickel extraction is more expensive from laterites, thus, most of the world's nickel comes from sulfide deposits. However, lateritic ore enjoys a major advantage in the combination of low mining cost and high value content. These two factors provide strong incentive to find economical means of extracting nickel from laterites (Reimann, et al 1998). Most of the world's production achieved from laterite use high grade (1.8% to 3.5%) ore (ibid.). Ore grades in the project area are thought to range from 0.8% to 1.0%.

The largest nickel laterite deposits are located in New Caledonia, Cuba, Indonesia and the Philippines. Together, these account for 75% of the total world nickel laterite resources. Burundi in central Africa contains about five percent of the world's known laterites (Russell 1998).

Current utilization of the total Western World nickel mining capacity is around 86%, an historically high figure. Operating rates are predicted to decline as low as 76% with the opening of new mines at Voisey's Bay in Canada in 2001-2003 (AME Mineral Economics 1998). Anaconda Nickel Limited of Australia has predicted a long term period of depressed nickel prices (about \$2.25/pound) as the nickel market prepares for the imminent substantial supply of nickel from new low-cost producers (Anaconda Nickel Limited 1998).

Stainless steel accounts for 40% of primary nickel consumed in the United States and two-thirds of world primary consumption. Demand for nickel-free grades of stainless steel is strong because of robust automotive sales. About 66,000 tons (35 percent of total consumption) of nickel was recovered from purchased scrap in 1998 (Kuck 1999).

The world nickel supply grew faster than demand in 1998. In August, the London Metal Exchange cash price dropped below \$4,300 per metric ton (\$1.95 per pound) - the lowest level in more than a decade. The oversupply situation is expected to continue for 4 or 5 years because of mine and smelter capacity additions in Australia, Canada, Indonesia, and Venezuela.

Since 1975, world demand for stainless steel has grown at an average rate of 4.5% per year. This growth rate is projected to continue for the next 20 years (ibid.).

The only nickel smelter in the United States closed in April 1998 because of low nickel prices. The smelter, near Riddle, Oregon, had been producing ferro-nickel from ores imported from New Caledonia (the adjoining mine on Nickel Mountain has been idle since 1996).

Cobalt is a valuable by-product of nickel laterites. The average cobalt credit per pound of nickel produced at the 1995 level is 24 cents (AME Mineral Economics 1998). Iron and chrome are also present.

Substitutes for nickel would result in increased cost or some trade-off in the economy or performance of the product. Aluminum, coated steels, and plastics can replace stainless steel to a limited extent in many applications

SOCIAL SETTING

About 7,500 acres within the analysis area are privately owned. The private land is generally residential and small wood lot, except for the land along Highway 199, which has been developed for industrial and commercial enterprises such as Rough and Ready Lumber Mill and the Illinois Valley Airport. The mill and airport has operated 24 hours/day from time-to-time. Both have noises, lights, and odors associated with their operations that can carry throughout the local valley. Within the analysis area, State and County road access is limited to Highway 199, Airport Drive, and Naue Way. These roads receive use by all kinds of traffic including heavy trucks and equipment. Some roads within the analysis area traverse private land and use is restricted by the landowner(s). People living along Rough and Ready Creek Road enjoy a sense of solitude because of the restricted access.

Recreation within the analysis area includes swimming, botanical exploration, hiking, and horseback riding. Most use occurs in the lower reaches of Rough and Ready Creek that are currently accessible to motorized vehicles.

The Siskiyou National Forest Plan Final Environmental Impact Statement discussed the social and economic factors affected by National Forest decisions. The Forest Plan FEIS states (page B-73, FEIS Appendix B):

In-migration has become a dominant force in the area's growth. In-migrants favor the area because of its high amenity and quality of life characteristics, i.e. clean air and water, the pace of life, and outdoor recreation. A significant proportion are retired persons.

Development of an interpretive trail within the Oregon State Botanical Wayside and BLM ACEC is in progress. The trail is sponsored by community groups and agencies, including the Illinois Valley Community Response Team (CRT), Garden Club, BLM and Oregon State Parks. The site is considered part of the overall strategy for economic development in the CRT Illinois Valley Strategic Plan.

Additional interpretive development opportunities intended to increase opportunities for nature-based tourism are being planned by IV CRT, among others. To this end, they have worked with the Scenic Byway Committees in the states of California and Oregon to designate Highway 199 a “Scenic Byway.” Rough and Ready Creek has been identified as one of the top tourist resources in the Illinois River Valley, and is a centerpiece for interpretation along the byway (Brandt memo, February 27, 1999). The lower reaches of Rough and Ready Creek remain accessible during the winter months, which makes it particularly important for off-season tourism (ibid.).

The West Fork Illinois River Watershed Analysis and the Rough and Ready Creek Wild and Scenic River Eligibility Study discuss the educational, scientific and amenity values associated with the analysis area. The area is highly valued by scientists and professors who bring groups to the alluvial flats to experience the botanical diversity and unique geological features. The serpentine geology has been the focus of many ecological studies and workshops.

ROADLESS CHARACTER

About 60 percent of the analysis area is associated with “roadless character,” a wild or primitive environment that is not readily accessible by road. Roadless character is valued by many people for its lack of human intrusion and opportunities for solitude. Roadless areas provide refuge for plants and animals because adverse effects related to access (wildlife harassment, habitat degradation, noxious weed introduction, and trash dumping, among others) are eliminated. Many people value the presence of a large roadless area near a rural population center such as Cave Junction. For more information on people’s values, see the West Fork Illinois River Watershed Analysis.

The area described as the South Kalmiopsis Roadless Area (SK) in Appendix C of the Siskiyou National Forest Plan does not necessarily possess roadless character, and there may be lands that possess this character that are not within the Appendix C boundary. Still, the Forest Plan inventoried roadless area description provides a useful baseline for roadless character effects analysis. The portion of the SK within the analysis area is consistent with the roadless area description in the Forest Plan.

Most road development within the area had occurred prior to the Forest Plan analysis. The development of mining roads likely had significant effects on roadless character when they were built (most of the roads appear to be in prior to the 1960's). Inspiration Mining Company extensively sampled the analysis area in the 1970's; the transportation system within the SK was improved to facilitate their explorations.

A roadless area study to consider additions to the Kalmiopsis Wilderness was initiated in the early 1970's, and again in the 1980's. The 1984 Oregon Wilderness Act did not add the analysis area to the Wilderness. The 1989 Siskiyou Forest Plan allocated these areas to non-Wilderness uses, including Administrative Study and Botanical Area.

The roadless character of the area has been maintained despite the presence of roads because access is limited (the unimproved character of the roads, a gate at the private land, unmaintained creek crossings) . The SK portion of the analysis area has had infrequent disturbance from mining exploration, and roads have had administrative (to access the Mendenhall Fire, for example), and generally non-motorized recreational use.

Nickel Bearing Laterites Mapped
In Rough & Ready Area

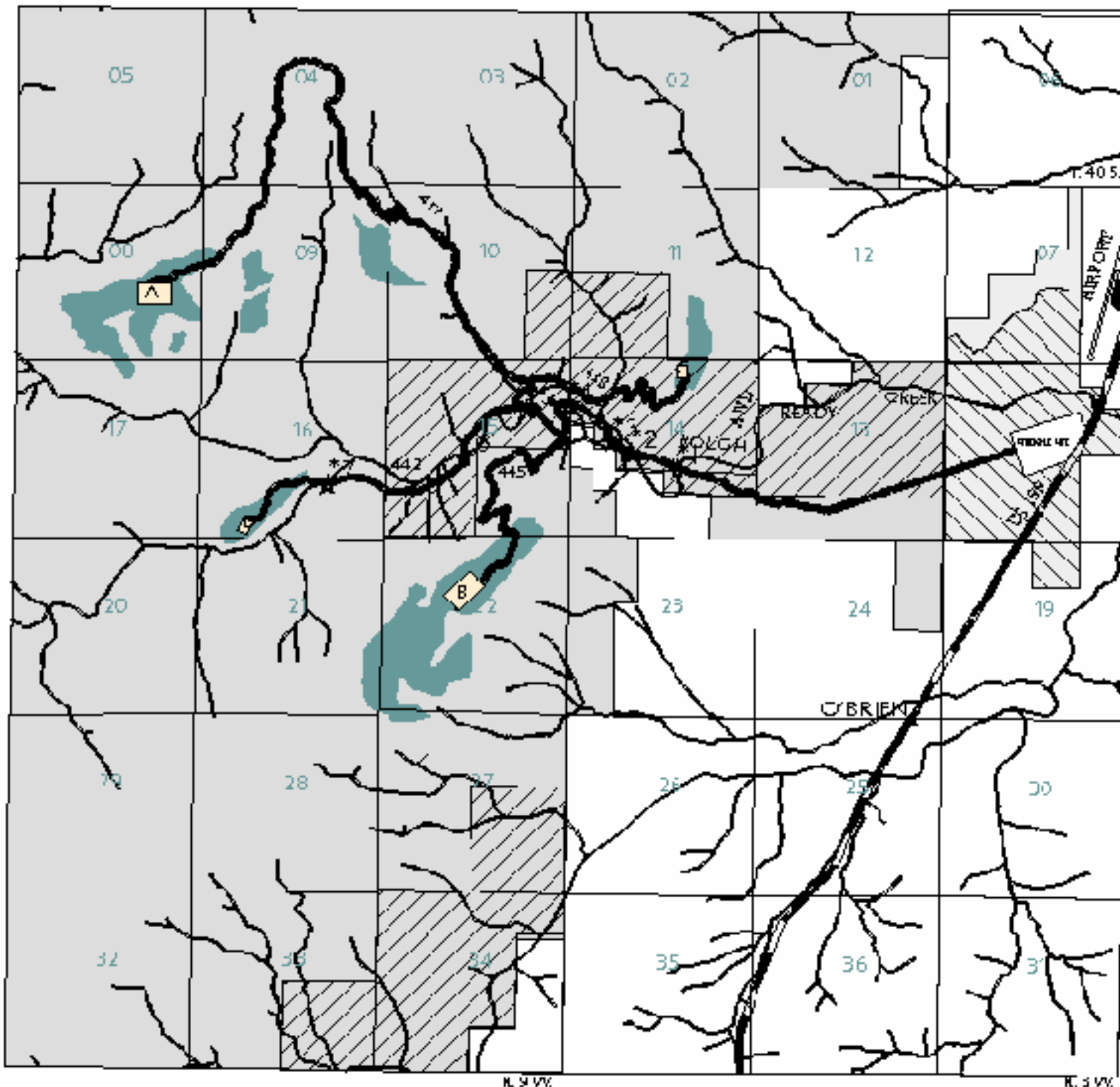


Figure 13